



Learjet Flight Test Update

Commercial Supersonic Technology Project
Advanced Air Vehicles Program

NASA Glenn Research Center (Acoustic Testing, Weather Measurements, Airworthiness/Flight Ops, Management)

NASA Langley Research Center (sUAS Operations, Weather Measurements)

NASA Acoustics Technical Working Group
April 12 - 13, 2022

Team



Research: Brenda Henderson (Glenn)
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Airworthiness/Flight Ops, Project Management: Jeff Polack (Glenn)
Matt Fakler (Glenn)
Kurt Blankenship (Glenn)

sUAS Operations and Related Weather Measurements: Mark Motter (Langley)
Jake Revesz (Langley)
Jen Fowler (Langley)
Thomas Jordan (Langley)

LIDAR Weather Measurements: Devin Boyle (Glenn)

Objectives



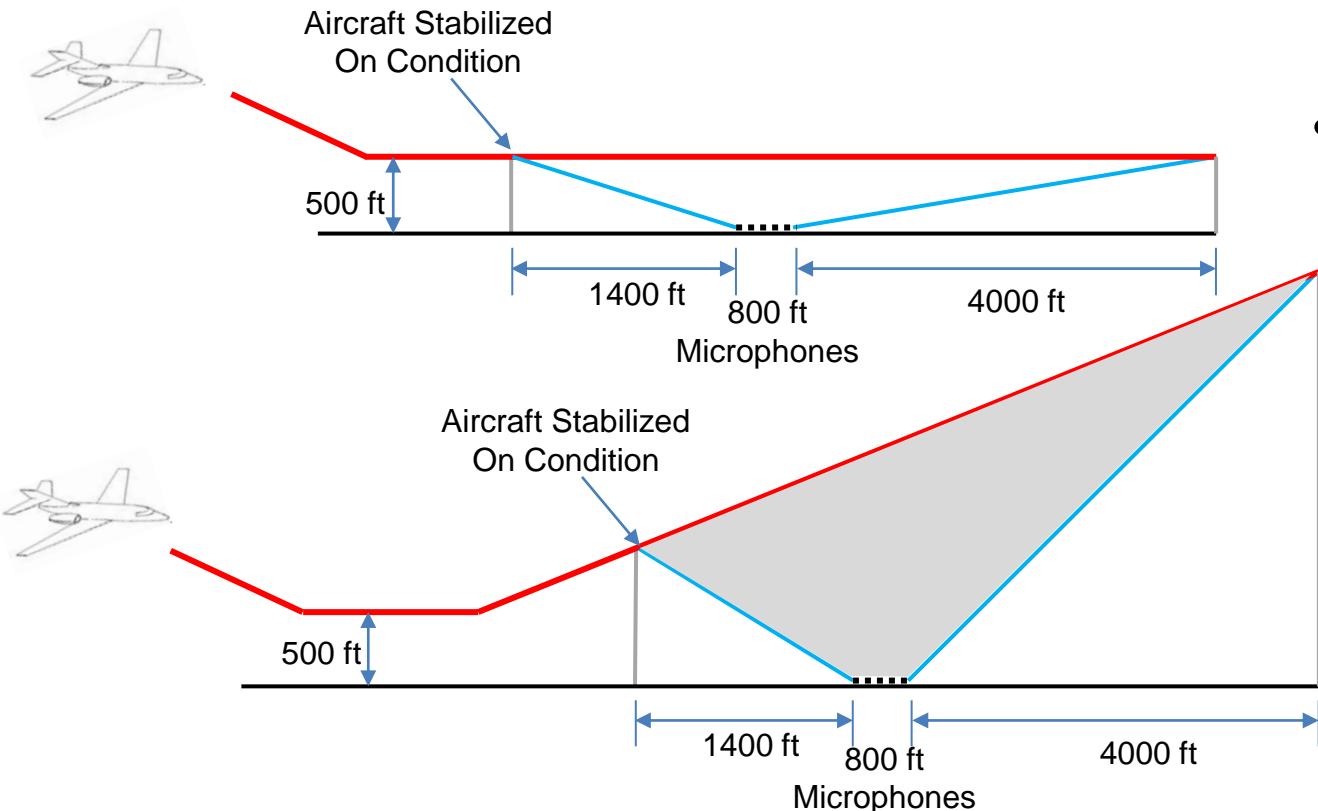
- Acquire jet-noise flight data from a Learjet 25
 - Compare results from AAPL to flight data
 - Develop flight correction model if required
- Learjet 25 selected to ensure a jet-noise dominated source
 - Uses CJ610 engine (derivative of the J85)

Desired outcome is to improve our ability to predict takeoff noise for future supersonic commercial aircraft

Learjet Flight Test Details

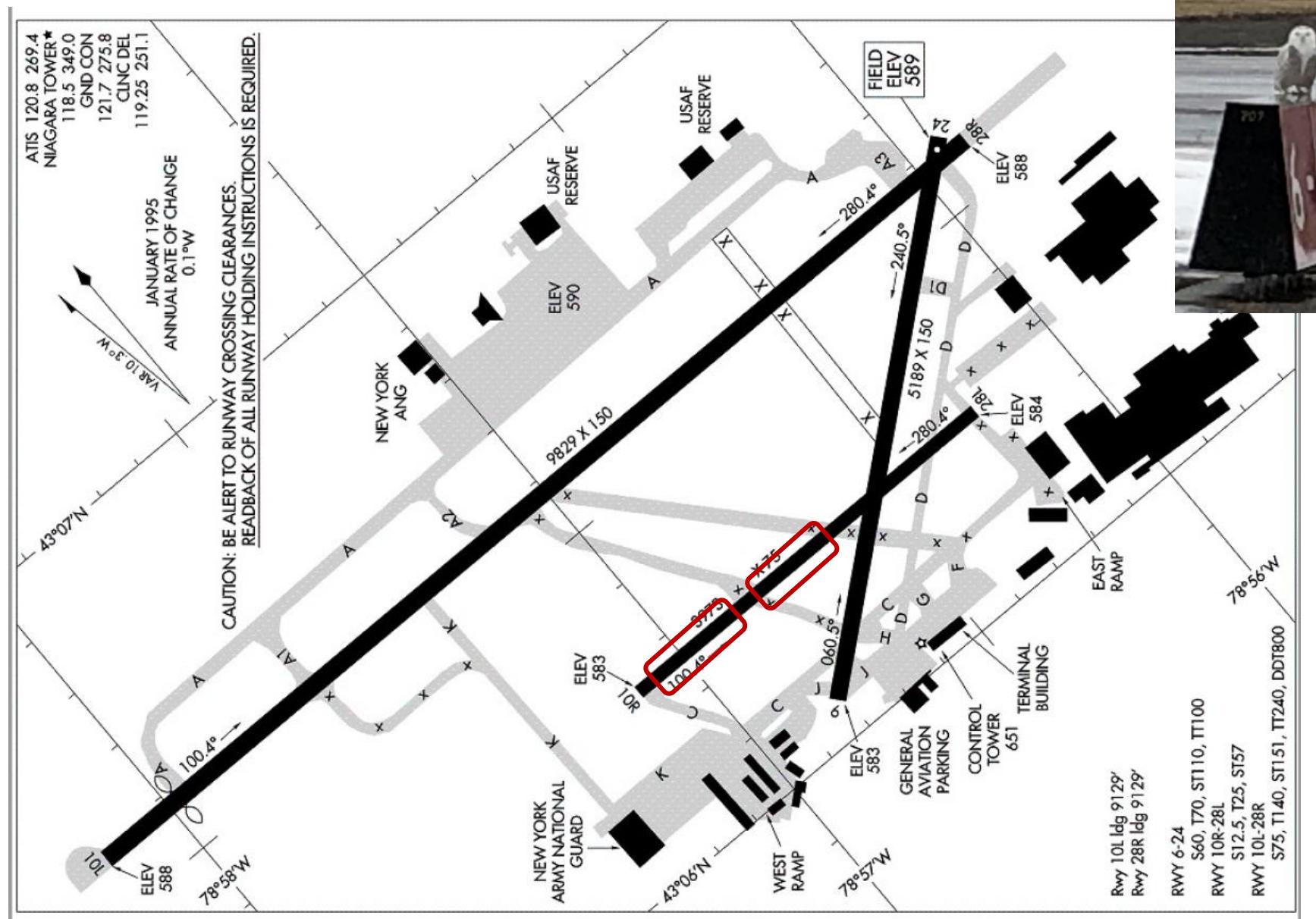


- Aircraft will be operated and instrumented by Calspan Corp.
 - Engine Pressure Ratio (EPR), Exhaust Gas Temperature (EGT), and engine RPM will be recorded
 - L1 and L2 GPS antenna
 - Recorded data will include a GPS timestamp
 - One engine will be at idle
 - Flight trajectories will include level flyover and climb to achieve desired engine conditions and flight speed
 - Flights will occur at Niagara Falls International Airport



- Preflight used to determine achievable engine conditions and flight speeds
 - Flight speeds will remain at or below Mach 0.3
 - Engine exhaust of interest in the mid subsonic and low supersonic regime

Planned Array Location



NASA Instrumentation

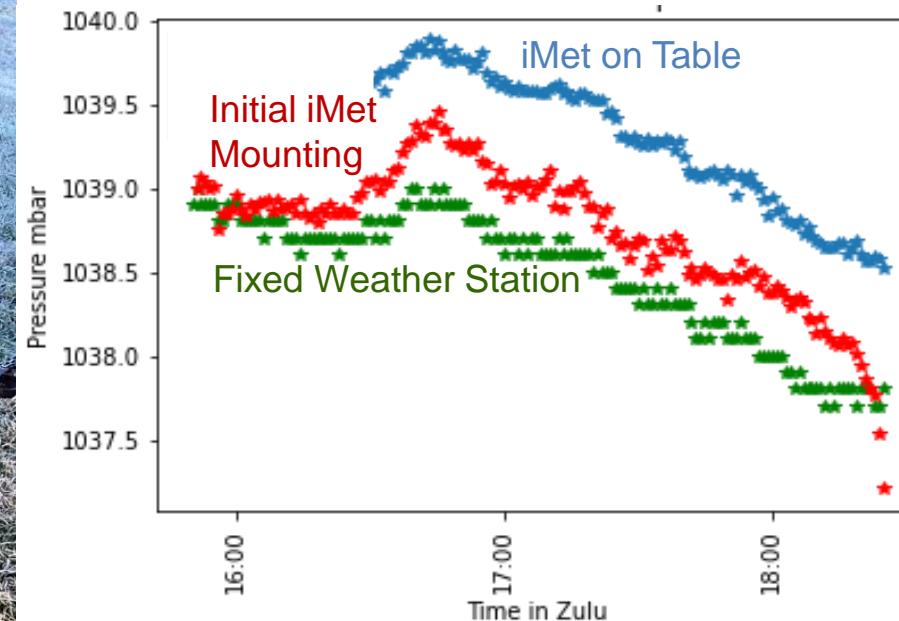


- Aircraft
 - Combined IMU (Inertial Measurement Unit) and GPS unit, and logging computer
 - Receiver is L1 and L2 capable
 - Aircraft location will be determined using post-processed kinematic (PPK) techniques (cm accuracy possible)
 - New York state base station within ~ 30 km (L1 and L2 needed for > 10 km)
- Acoustics
 - 8 Ground plate microphones will be used in the microphone array (the intent of this test is not certification type data)
 - Array will be located directly beneath the flight path
 - Microphone array will be GPS timestamped
- Weather – layered atmospheric conditions recorded up to an altitude of ~600 ft
 - Using an SUAS for temperature, pressure, humidity
 - LIDAR system (on loan from Langley, operated by Glenn) for wind speed

sUAS Weather Measurements



- sUAS – Freefly Alta 8
 - Autopilot used for flights
- Instrumentation
 - Pressure, temperature, humidity
 - iMet-XQ2
 - Built-in data logger
 - Data GPS timestamped
 - Validation against stationary weather station
 - Altitude
 - Second autopilot with RTK system (only used for RTK)
 - Base station included in Langley setup
 - Combination laser altimeter (distance limitation) and barometric pressure
 - Data GPS timestamped
 - Data acquired before and after Learjet flights and at intervals in-between (maybe 1/hour)



LIDAR Measurements



- NGR Systems Inc., Model ZX300
- Used for wind speed
- Unit used by RVLT project for helicopter and UAM/AAM field measurements
- Will be loaned to Glenn and CST project for Learjet test



T-34 GPS Trial Flights



- Cleveland Area
 - Ensure GPS system is functioning properly
- Niagara Falls International Airport
 - Ensure ability to record necessary satellite and base station data in flight test location



Schedule



Task	Date
Contract Award	September 2021
Site Visit to Select Test Location	January 2022
Weather Station Drone Flights Initiated	February 2022
All Required Hardware Delivered	February 2022
T-34 Flight Test for GPS Checkout	April - May 2022
Learjet Pre-Flight and Flight Tests	June - July 2022

Additional Details

- All required and most backup hardware has been delivered

Questions and Feedback



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